ABSTRACT SUBMISSION FORM
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Title of Paper	**Flex Dynamics Avoidance Control of the NEA Scout Solar Sail Spacecraft's Reaction Control System**

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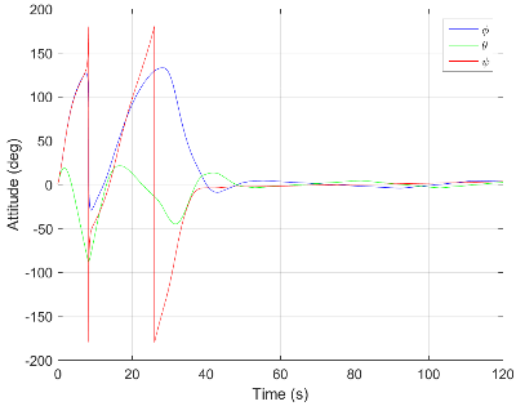
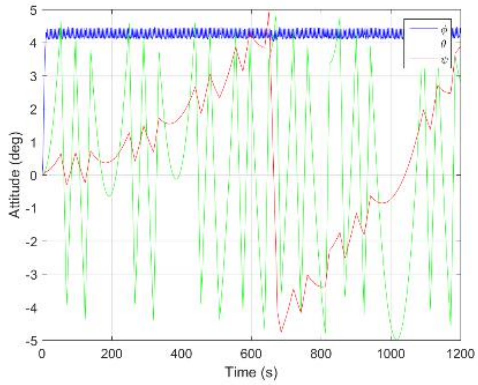
// Abstract (about 400 words)
An abstract should provide a clear and concise statement of the problem to be addressed, the proposed method of solution, and the results expected or obtained, with pertinent references and supporting tables and figures as necessary.

The Attitude Control System (ACS) is developed for a Near Earth Asteroid (NEA) Scout mission using a solar sail. The NEA-Scout spacecraft is a 6U cubesat with an 86 square-meter solar sail. NEA Scout will launch on Space Launch System (SLS) Exploration Mission 1 (EM-1), currently scheduled to launch in 2018. The spacecraft will rendezvous with a target asteroid after a two year journey, and will conduct science imagery. The solar sail spacecraft ACS consists of three major actuating subsystems: a Reaction Wheel (RW) control system, a Reaction Control System (RCS), and an Adjustable Mass Translator (AMT) system. The three subsystems allow for a wide range of spacecraft attitude control capabilities, needed for the different phases of the NEA-Scout mission. Because the sail is a flexible structure, care must be taken in designing a control system to avoid exciting the structural modes of the sail. This is especially true for the RCS, which uses pulse actuated, cold-gas jets to control the spacecraft's attitude. While the reaction wheels can be commanded smoothly, the RCS jets are simple on-off actuators. Long duration firing of the RCS jets – firings greater than one second – can be thought of as step inputs to the spacecraft's torque. On the other hand, short duration firings – pulses on the order of 0.1 seconds – can be thought of as impulses in the spacecraft's torque. These types of inputs will excite the structural modes of the spacecraft, causing the sail to oscillate. Sail oscillations are undesirable for many reasons. Mainly, these oscillations will feed into the spacecraft attitude sensors and pointing accuracy, and long term oscillations may be undesirable over the lifetime of the solar sail. In order to limit the sail oscillations, an RCS control scheme is being developed to minimize sail excitations. Specifically, an input shaping scheme similar to the method described in Reference 1 will be employed. A detailed description of the RCS control scheme will be provided with particular emphasis on flexible body excitation. The RCS performance will be provided to show that sail and boom excitation is minimized.





(a) ***(b)***

Figure 1: *(a) Attitude control response using RCS during initial detumble, and (b) during a thrust correction maneuver.*

References

1. A. Banerjee and B. Diedrich, *Spacecraft Vibration Reduction Following Thruster Firing for Orbit Adjustment*, AIAA Journal of Guidance VOL. 26, NO. 4: Engineering Notes.